A.D. 1848 . . . . N° 12,190.

SPECIFICATION

OF

GEORGE EMMOTT.

UEL, FURNACES, FLUES, BOILERS, &c.

LONDON:
PRINTED BY GEORGE E. EYRE AND WILLIAM SPOTTISWOODE,
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1854.

A.D. 1848 . . . . N° 12,190.

Fuel, Furnaces, Flues, Boilers, &c.

EMMOTT'S SPECIFICATION.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, George Emmott, of Oldham, in the County of Lancaster, Civil Engineer, send greeting.

WHEREAS Her present most Excellent Majesty Queen Victoria, by Her Letters Patent under the Great Seal of the United Kingdom of Great Britain and Ireland, bearing date at Westminster, the Sixteenth day of June, in the eleventh year of Her reign, and in the year of our Lord One thousand eight hundred and forty-eight, did give and grant unto me, the said George Emmott, my ex̃ors, adm̃ors, and assigns, Her especial license, full power, sole privilege and authority, that I, the said George Emmott, my ex̃ors, adm̃ors, and assigns, and such others as I, the said George Emmott, my ex̃ors, adm̃ors, or assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term of years therein mentioned, should and lawfully might make, use, exercise, and vend, within that part of the United Kingdom of Great Britain and Ireland called England, Her Dominion of Wales, and Town of Berwick upon Tweed, my Invention of "Certain Improvements in the Manufacture of Fuel, and in the Construction and Arrangements of Furnaces, Flues, Boilers, Ovens, and Retorts, having for their Object the Economical Application of Caloric, the Manufacture of Gas for Illumination, and the Consumption of Smoke and other Gaseous Products;" in which said Letters Patent there is contained a proviso requiring that I, the said George Emmott, shall particularly described and ascertain the nature of my said Invention, and in what manner the same is to be performed, by an instrument in writing under my hand and seal, to be enrolled in Her said Majesty's High Court of Chancery within six calendar months next and immediately after the date of the said in part recited Letters Patent, as, reference being thereunto had, will more fully and at large appear.

NOW KNOW YE, that in compliance with the said proviso, I, the said George Emmott, do hereby declare that the nature and particulars of my said Invention, and the manner in which the same is to be carried into effect, is fully described and ascertained in and by these presents, and the various Sheets of Drawings hereto annexed, the Figures upon which Drawings are made to the scale or proportional size marked thereon, the same letters of reference being also used to indicate the same part or parts throughout the series, that is to say:—

My Invention relates, firstly, to the manufacture of fuel by effecting the carbonization of coals in ovens or retorts wholly or partially closed at pleasure, as herein-after described. Secondly, to certain novel methods which I make use of to render and maintain ovens used for the carbonization of coals perfectly or partially air-tight at pleasure, by which I am enabled to consume or apply to various useful purposes the gaseous products resulting from such carbonization, thereby effecting a more economical application of caloric, a saving in the amount of fuel consumed in the furnaces beneath the ovens, and at the same time effectually preventing the free escape of dense volumes of opaque smoke to the atmosphere. In ordinary coke ovens, while the process of carbonization is carried on, the whole of the gaseous products are permitted to excape from the top of the oven, or are conveyed through flues to a chimney, from which their noxious fumes are poured upon the surrounding country. To remedy these evils I employ "valves," "dampers," "hydraulic cups," "an exhausting apparatus," "fan," "blower," or any suitable machinery by which an uniform draught can be regulated. These apparatus, or any of them, I attach to the ovens or to the pipes and flues connected therewith in such a manner as to prevent the escape of the gaseous products to the atmosphere, and at the same time carry them forward through a series of pipes to a gasometer or receiver, where their various components may be separated, the gas suitable for illumination be purified accordingly, and its application to a variety of useful purposes effected at pleasure. So soon (as determined by practise) the gaseous products evolved are unfit for further useful application, I immediately close the valves, dampers, or apparatus employed to regulate their admission to the gasometer or receiver, and opening the ordinary valves and dampers, the carbonizing process goes on in the ordinary manner until the manufacture of the fuel is complete. Thirdly, my Invention relates to the combination of a coke oven or retorts with a steam boiler (or other vessel used for the purposes of evaporation) under one combined system of furnaces and flues; thus by fixing a coke oven at the side of or near to a steam boiler or other vessel to which heat is applied, and the flues being so arranged in connection with each that so soon as the delivery of the gaseous products to the gasometer or receiver is complete, as mentioned under my second series of improvements, the heat or caloric resulting from the further carbonization of the fuel in the oven is conveyed along flues beneath, around, or through the steam boiler previous to its delivery to the chimney shaft. Fourthly, my Invention relates to certain novel arrangements in connection with furnaces and flues as applied to steam boilers or other useful purposes, whereby the consumption of the gaseous products evolved by the combustion of fuel in such furnaces is secured, and the nuisance of opaque smoke entirely prevented, an important feature in this smoke consuming apparatus being that the furnace can be fired by hand in the ordinary manner, although I give preference to the more regular method of firing by the machine or hopper. The fire box of my improved furnace is furnished with a double set of grate bars of equal lengths each, the front or dead plate being made rather broader than ordinary, and the first or front length of fire bars being about one inch in width upon their face, and placed so nearly in contact with each other that the apertures between them will present but a limited space for the admission of air to the fuel; this part of the fire box very nearly resembles a close furnace. The dead plate and the front length of fire bars are placed upon a horizontal plane, while the second or back length of bars rise from them towards the back of the boiler with an inclination of at least one and a quarter inches for every foot in the direction of their length; these bars are made very thin, with their upper edges coved or hollowed, and are placed so far asunder as to ensure a liberal supply of common air to this part of the furnace. This second or back length of fire bars I feed by means of the firing machine with that description of fuel known as gas cokes, (or with the carbonized fuel manufactured in the processes herein described,) from its being the carbonized residuum of coals from which carburetted hydrogen or gas for illumination has been manufactured, while the first or front range of fire bars I feed by hand with a fuel consisting of small coals or of a mixture of coal dust with coal tar, or of coal tar, saw dust, ashes, or other combustible substances combined, the gaseous products and opaque smoke given off from these materials being effectually consumed while passing over the heated cokes spread upon the second or back length of fire bars. Fifthly, my Invention relates to certain novel arrangements of retorts for the distillation of carburretted hydrogen or common gas in connexion with the furnaces and flues of steam boilers and other vessels to which heat is applied, whereby I am enabled to manufacture gas for illumination or for fuel for the furnace fires, as hereafter described, and effectually to consume the smoke and gaseous products evolved by the ignited fuel in the furnace. For this purpose, I place a retort or retorts made of fire-clay, fire-bricks, or iron, at the side of or between steam boilers, for the purpose of wholly or partially carbonizing the coals or for manufacturing the gas cokes required in my before-described improved process of consuming the smoke. The gaseous products arising from such carbonization or dry distillation I convey by the common modes of gas-making to a gasometer or receiver, as before described, but the gaseous products and caloric resulting from the combustion of the fuel in the furnaces beneath the retorts, instead of being permitted to escape to a chimney, is wholly conveyed by means of flues at any convenient angle with the side of the boiler into the fire box or into the flues thereof, where the effective application of such products for generating steam or for other purposes is secured. The gas collected in the receiver or gasometer I make use of as fuel in the following manner:—At the farther end of the fire box described under my fourth series of improvements, and upon or near to the bridge wall thereof, I erect a wall of perforated fire-bricks or of fire-clay tubes or fire-clay blocks perforated with as many orifices or apertures in each as may be necessary, the upper surface of these blocks or wall of blocks being raised a few inches above the level of the grate bars at the back of the fire box. Into the apertures of these fire clay blocks I introduce gas from the gasometer or receiver, which gas igniting at the orifices on the upper surface of the blocks forms an entire sheet of flame across the end of the fire box, and any gaseous products or opaque smoke arising from the combustion of coals or other materials in the furnace coming in contact therewith is effectually and entirely consumed. Having thus explained the particular nature of my improvements, I shall next proceed to exemplify their practical application by the following—

DESCRIPTION OF THE DRAWINGS.

On Drawing N° 1, Fig. 1 is a side elevation, and Fig. 2 is a plan; while on Drawing N° 2, Fig. 3 is a longitudinal section; Fig. 4 is a transverse section; and Fig. 5 a sectional plan of a series of coke ovens or retorts arranged according to my present improvements. A. A, are the coke ovens in which the process of carbonization is carried on. These ovens are placed back to back, and are fed from the top by removing the lids B, B, and passing the coals into them through the hoppers C, C, until these ovens A, A, are duly charged with fuel, fires being previously kindled beneath them in the furnaces D, D; and the heated vapours and gaseous products from such fires making the passage of the flues *d*, *d*, beneath, around, and above the ovens A, A, as indicated by the direction of the small arrows, it follows that the useful effect of the caloric is thoroughly distributed in making the circuit of the ovens A, A, the gaseous products effectually consumed, and the delivery of any vaporous matters or opaque smoke from the chimney shaft avoided. So soon as the ovens A, A, are sufficiently heated, the carbonizing process takes place; and in order to secure the valuable products resulting from this dry distillation of the coals contained therein, I close the lids B, B, upon the top of the hoppers C, C, and open the hydraulic cups E, E, by which means the gaseous matters evolved by the carbonization of the coals in the ovens A, A, ascend through the pipes *e*, *e*, and are conveyed along the pipes *f*, *f*, to the gasometer F. The purification of the carburretted hydrogen or gas for illumination, its separation from and the collection of the residual matters contained in such products being effected in the ordinary manner. To ensure the constant delivery of these gaseous products from the ovens A, A, through the pipes *e*, *e*, and *f*, *f*, to the gasometer F, I employ an exhausting apparatus of any convenient form or description suited for the purpose, which fan or exhausting apparatus is contained in the cylinder G, and is placed in connexion with the pipes *f*, *f*, leading from the ovens A, A, to the gasometer F, in such a manner that an uniform draught can be maintained thereby, and the supply of the gaseous products from the ovens A, A, continue without interruption. This apparatus I drive by means of a strap or band (shewn in dotted lines) from the fly wheel upon the shaft of the small steam engine seen in plan at H, Fig. 2. So soon (as determined by practise) the operator in attendance discovers the products given forth by the carbonization of the coals in the ovens A, A, to be unfit for application to any of the before-mentioned purposes, the hydraulic cups E, E, should be closed, which is readily effected by means of the chains *h*, *h*. The lids B, B, on the top of the hopper C, C, communicating with the ovens A, A, should be partially opened at discretion, and the carbonizing process carried on in the ordinary manner, until the manufacture of the fuel is complete. As the carbonizing process arrives towards completion, I cease to maintain the fires in the furnaces D, D, beneath the bars A, A, at their former intensity of heat, and the lids B, B, being open, as before described, a supply of air sufficient to sustain combustion is introduced within the ovens A, A. Placed at the side of the ovens A, A, is the steam boiler I, and the caloric and gaseous products given forth from the fires in the furnaces D, D, after making the circuit of the flues *d*, *d*, I pass under this steam boiler through the flues *b*, *b*, shewn in dotted lines, and thus generates sufficient steam to drive the steam engine H before mentioned. The doors *a*, *a*, of the ovens A, A, are merely used for the purpose of withdrawing the cokes, and for regulating the surface of the coals as introduced from the hoppers C, C, as occasion may require, and thus exposing them thoroughly to the process of carbonization. It being worthy of remark that such manufacture has been effected without the loss or waste of the gaseous matters and the residuum thereof given forth from the coals, the nuisance of opaque smoke being also avoided. I would also add, that when instead of the manufacture of fuel the manufacture of gas for illumination is the special object in view, then this process and the apparatus employed in connexion therewith offer great facilities for obtaining a large supply of gas in a very short space of time, inasmuch as owing to the extended surface of my ovens and retorts, the fuel is more thoroughly exposed to the action of the heat, and the distillation of the gaseous products is rendered more perfect than by the methods in ordinary use. Fig. 6, Drawing N° 3, shews an arrangement of boilers for the generation of steam, and of a retort or coke oven for the manufacture of fuel, and of gass for illumination, under a combined system of furnaces and flues. Fig. 7 is a longitudinal section of one of the boilers; and Fig. 8 is a plan of the boilers and retorts, shewing the arrangement of the fire bars, and my novel method of consuming the smoke, as described under my fourth and fifth series of improvements. K is the oven for manufacturing carbonised fuel, seen in dotted lines behind the brickwork *k*, the arrangements in connexion with the conveyance of the gaseous products to the gasometer being similar to those formerly described. Referring to the plan view, Fig. 8, N is the dead plate, and *n*, *n*, are the first or front length of fire bars, whose breadth transversely is much greater than that of the spaces between them, and consequently the supply of air to this portion of the furnace is limited in proportion to its extent. O, O, are the second or back length of fire bars, whose upper surfaces are hollowed out, and the spaces between which are much greater than those between the first or front length of fire bars *n*, *n*; by referring to Fig. 7 it will be seen that the dead plate N, and the front length of fire bars *n* are upon the same level plane, while the back length of fire bars *o* rise from these with a slight inclination towards the bridge of the furnace P. Upon this back length of fire bars I place the partially carbonized fuel known as gas cokes, which are delivered thereupon by the firing machine or hopper M, which is suitably speeded in order to insure a regular and constant supply of fuel. The first or front length of fire bars *n*, *n*, I feed by hand from the fire door *m* with the mixture of small coal ashes, tar, and other materials before described, the smoke and gaseous products resulting from which passing over the heated cokes upon the back length of fire bars *o* are effectually consumed. The carbonaceous products resulting from the combustion of the fuel in the furnaces beneath the retorts I pass by means of the flues Q, Q, into the fire box furnaces or flues beneath or around the steam boilers, and effectuate the combustion of these products, and of the residual gaseous matters remaining in these fire boxes, furnaces, and flues, in the following manner:—At the back of the fire bars *o*, and near to the bridge of the furnace, I build a wall of fire clay blocks R, R. These blocks are provided with apertures *r*, *r*, in the direction of their length, the orifices of which are open to the furnace; these blocks are also fitted with or built into each other, as shewn in the detached view, Fig. 9. The lower parts of these fire-clay blocks, which are circular, are fitted into the sockets *s*, *s*, *s*, which sockets are projections cast upon the rectangular tubes T, T. These rectangular tubes extend transversely across the ash-pit of the furnace, and are connected to the pipes U, U, leading to the gasometer L. So soon as the taps or cocks V, V, are opened a supply of gas from the gasometer L enters the furnace, which ascending through the orifices *r*, *r*, in the fire-clay blocks R, R, ignites immediately upon its entrance, forming a complete sheet or bridge of flame, extending across the bridge of the fire box, with which flame any gaseous products, carbonaceous matters, or opaque smoke coming into contact are effectually and entirely consumed. In order to regulate the admission of air to the back of the furnace, I make use of the perforated air plate W, beneath which I place the valve or damper X, whose fulcrum is at X^1. This valve or damper can be wholly or partially closed at pleasure by means of the bent lever Y. The operator in attendance having always at command a simple and effective method of regulating and maintaining a supply of air sufficient to effectuate combustion. Upon the sockets *s*, *s*, immediately beneath the orifices *r* in the fire-clay blocks R small apertures are made, into which are fitted the plugs or screws Z, Z, which, in case the orifices *r* in the fire-clay blocks R should become filled or closed by ashes or other extraneous matters, I remove, and passing a small rod up the orifices in the fire-clay blocks cleanse them from all such substances, and maintain them in a state fitted for effective service.

Having now fully described the nature and particulars of my said Invention of certain improvements in the manufacture of fuel, and in the construction and arrangements of furnaces, flues, boilers, ovens, and retorts, having for their object the economical application of caloric, the manufacture of gas for illumination, and the consumption of smoke and other gaseous products, I wish it to be understood that I do not confine myself to the precise arrangements of the mechanical details herein set forth, or any one of them, so long as the novel features of my Invention or any part thereof be retained; neither do I claim any of the ordinary and well-known apparatus or materials described in connection with my Invention, excepting so far as these may be indispensable for effectuating all or any of my improvements. Neither do I confine myself to the particular details relating to the methods of consuming gas as an article of fuel, inasmuch as it may be introduced to the furnace in different ways and consumed with equal effect, nor to the precise mixtures of tar, ashes, coals, &c., so long as the consnmption of the products evolved by their combustion, or of any one of them, is effectuated as described. The characteristic features of this my Invention being that no waste of coals or of the products resulting from the combustion or carbonization thereof, or of the caloric contained therein, is permitted to take place, but that the whole of these products are retained and applied to a variety of useful purposes as described; and the novelties which I claim in this my present Specification of Letters Patent granted unto me as aforesaid are, first, the manufacture of fuel by the carbonization of coals in ovens or retorts opened or closed at convenience, as described. Second, the recovery of the gaseous products evolved by such carbonization, which are ordinarily wasted, and the methods of effecting the application of such products as gas suitable for the purposes of illumination, or for imparting caloric to ovens, steam boilers, and other vessels or apparatus requiring heat, as also the application of the residuum of such products to various useful purposes. Third, to the combination of a coke oven or retort and steam boiler or other vessel used for the purposes of evaporation under one common system of furnaces and flues. Fourth, to the arrangements as described, or any mere modification of the same, whereby the smoke and gaseous products resulting from the combustion of fuel in the furnaces of steam boilers and other vessels or apparatus is effectually consumed. Fifth, the introduction of carburretted hydrogen or common gas within the fire box or furnaces of steam boilers or other vessels or apparatus, and effecting the combustion of the same at the back of the fire bars near to or upon the bridge of such furnaces, or in any other position or place therein, whereby the smoke and gaseous products given forth from the ignited fuel is effectually consumed by the combustion of such carburretted hydrogen or common gas. Sixth, to the arrangements as described, or any mere modification thereof, by which the manufacture of carburretted hydrogen or gas for illumination is carried on by means of retorts in connexion with the furnaces and flues of steam boilers or other vessels or apparatus. The whole of which being, to the best of my knowledge and belief, new, and never before practised in that part of Her said Majesty's said United

A. D. 1848. JUNE 16. Nº 12,190.
EMMOTT'S SPECIFICATION.

FIG. 1. ELEVATION

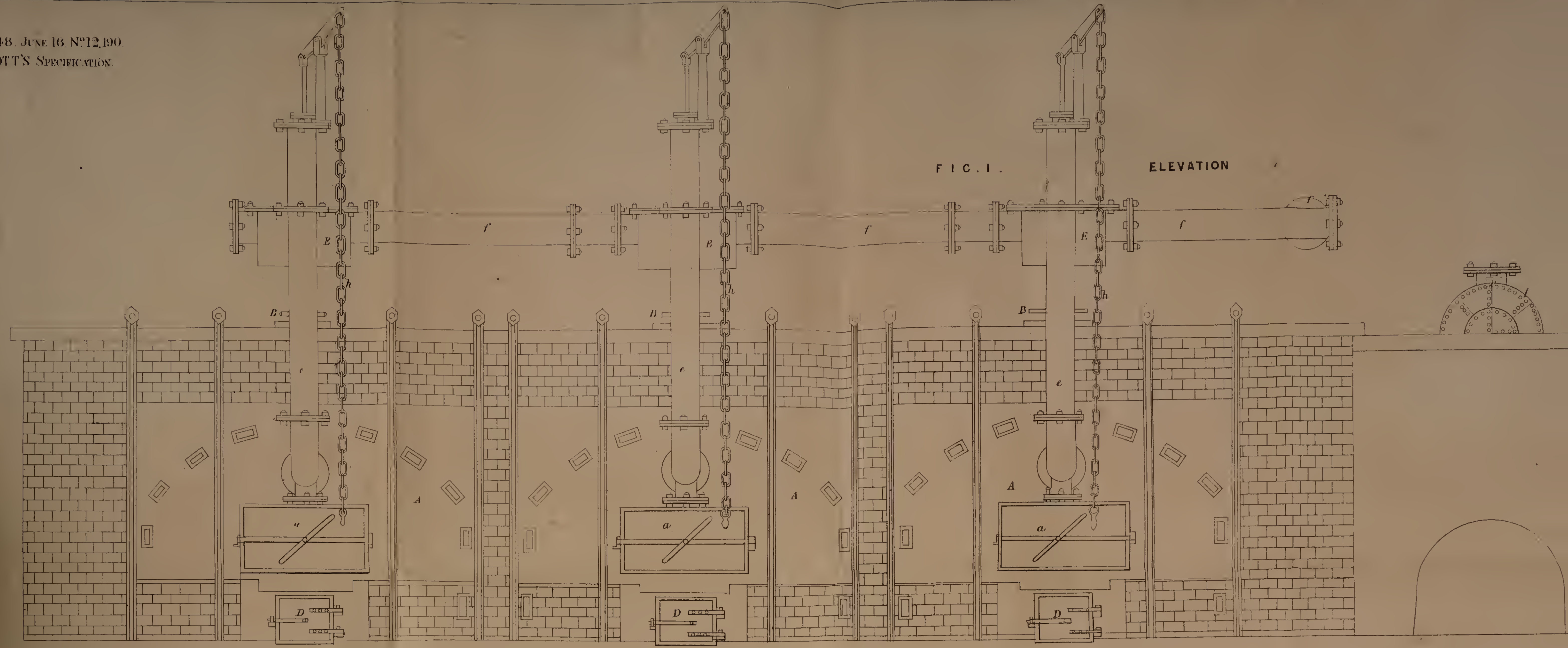
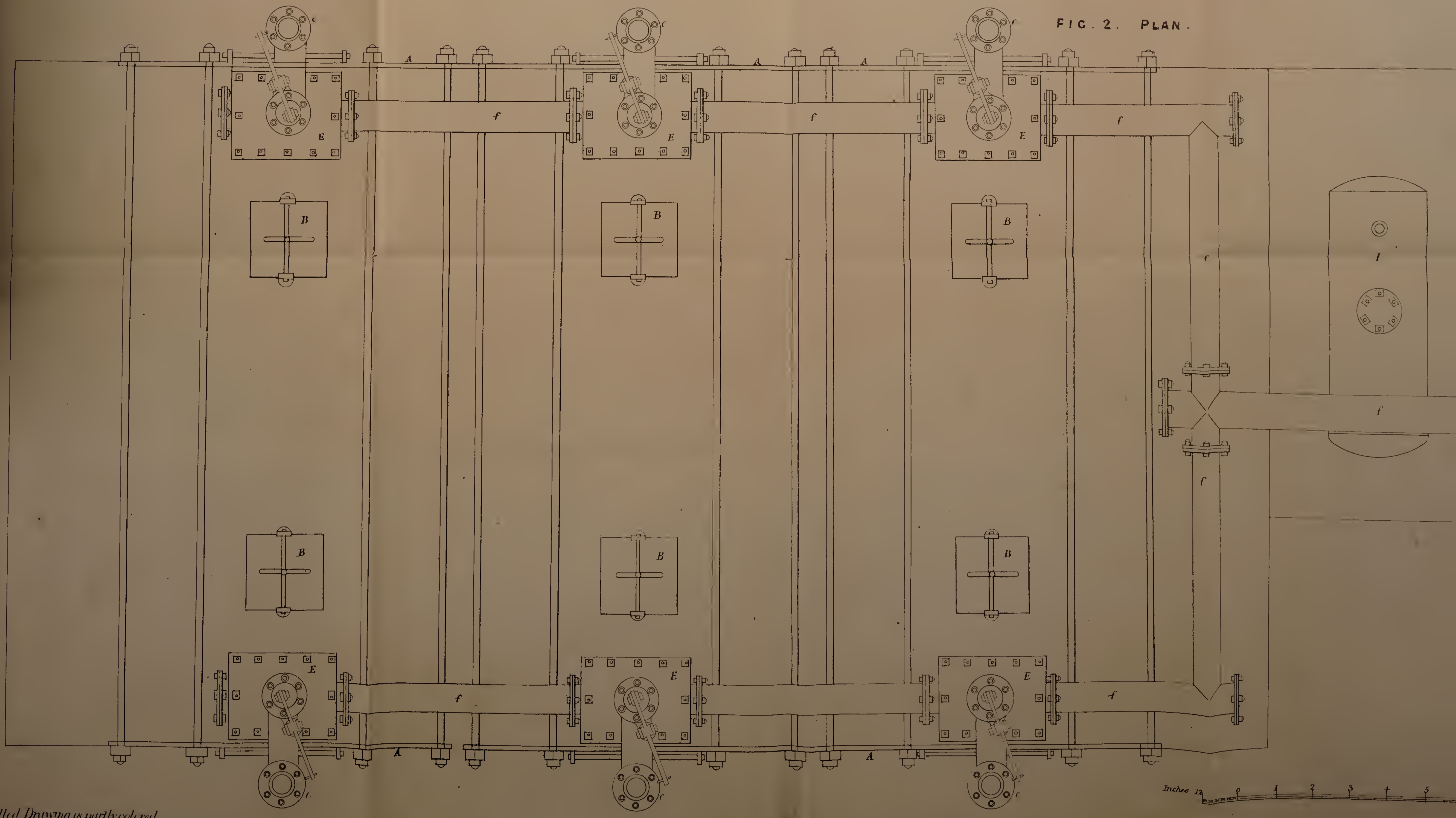


FIG. 2. PLAN.



e Enrolled Drawing is partly colored.

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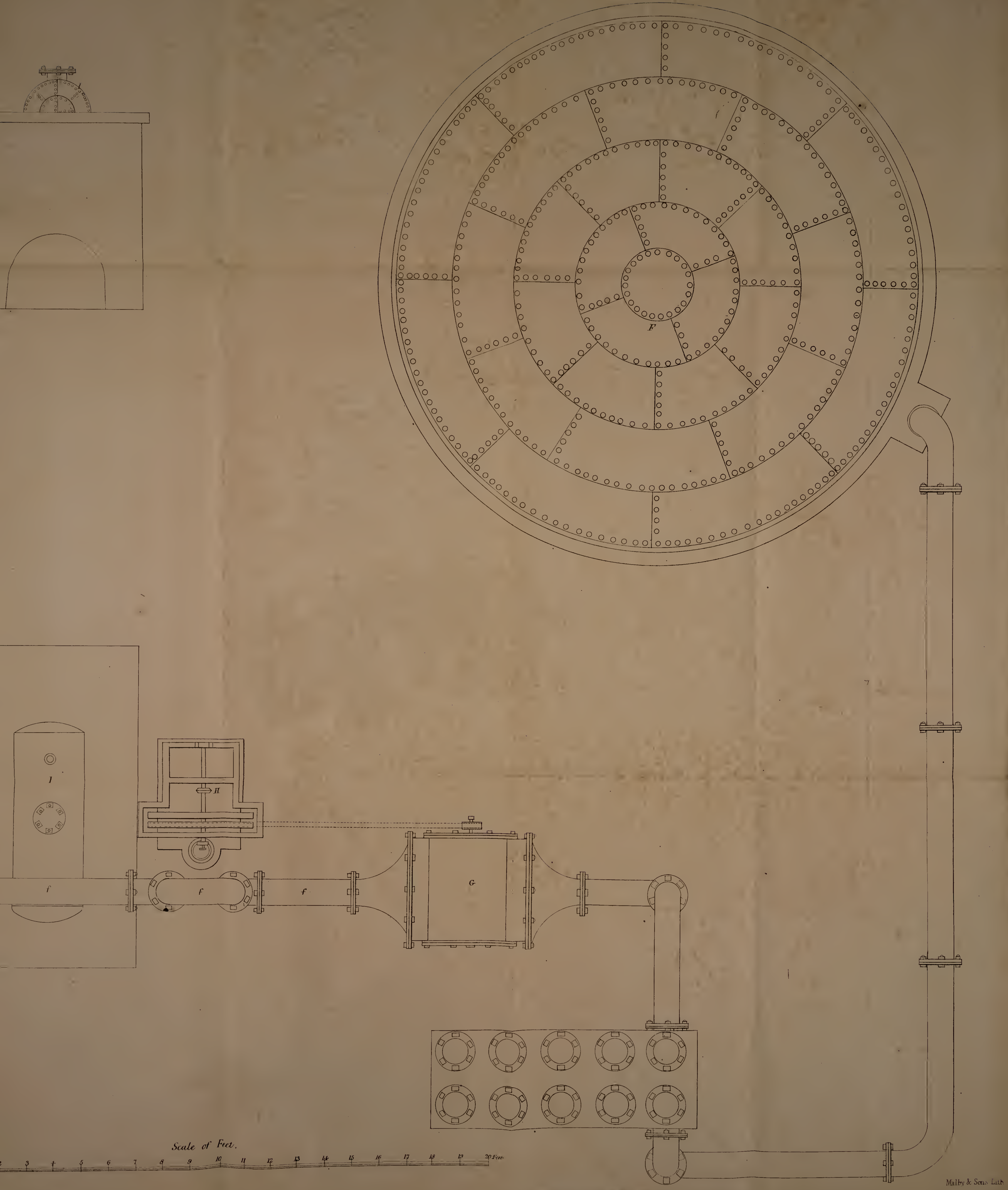
(3 SHEETS)
DRAWING No 1



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Queen's most Excellent Majesty 1855

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EMMOTT'S SPECIFICATION.

(3 SHEETS.)
DRAWING Nº 2.

FIG. 3.
Longitudinal Section

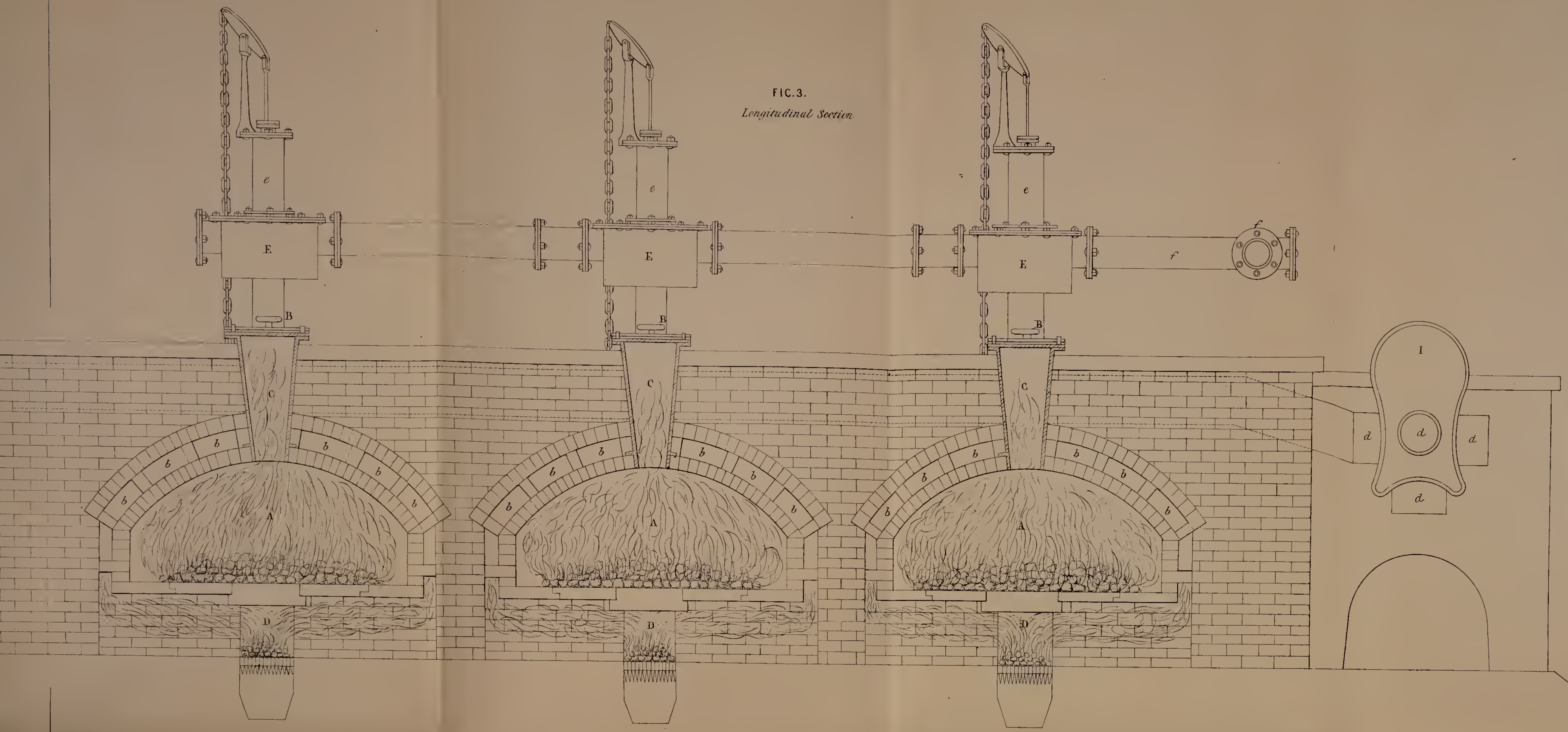


FIG. 4.
Transvers Section.

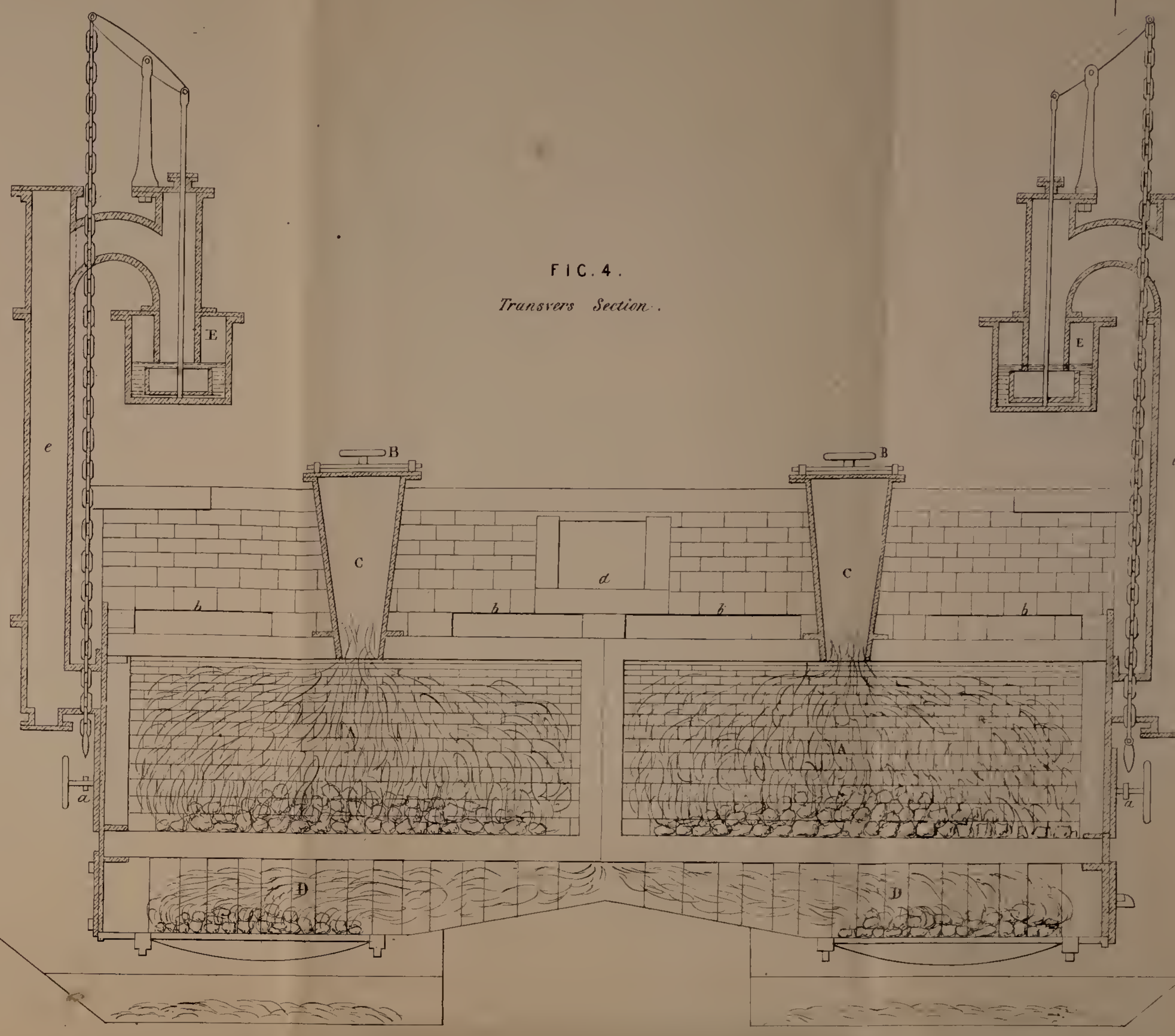
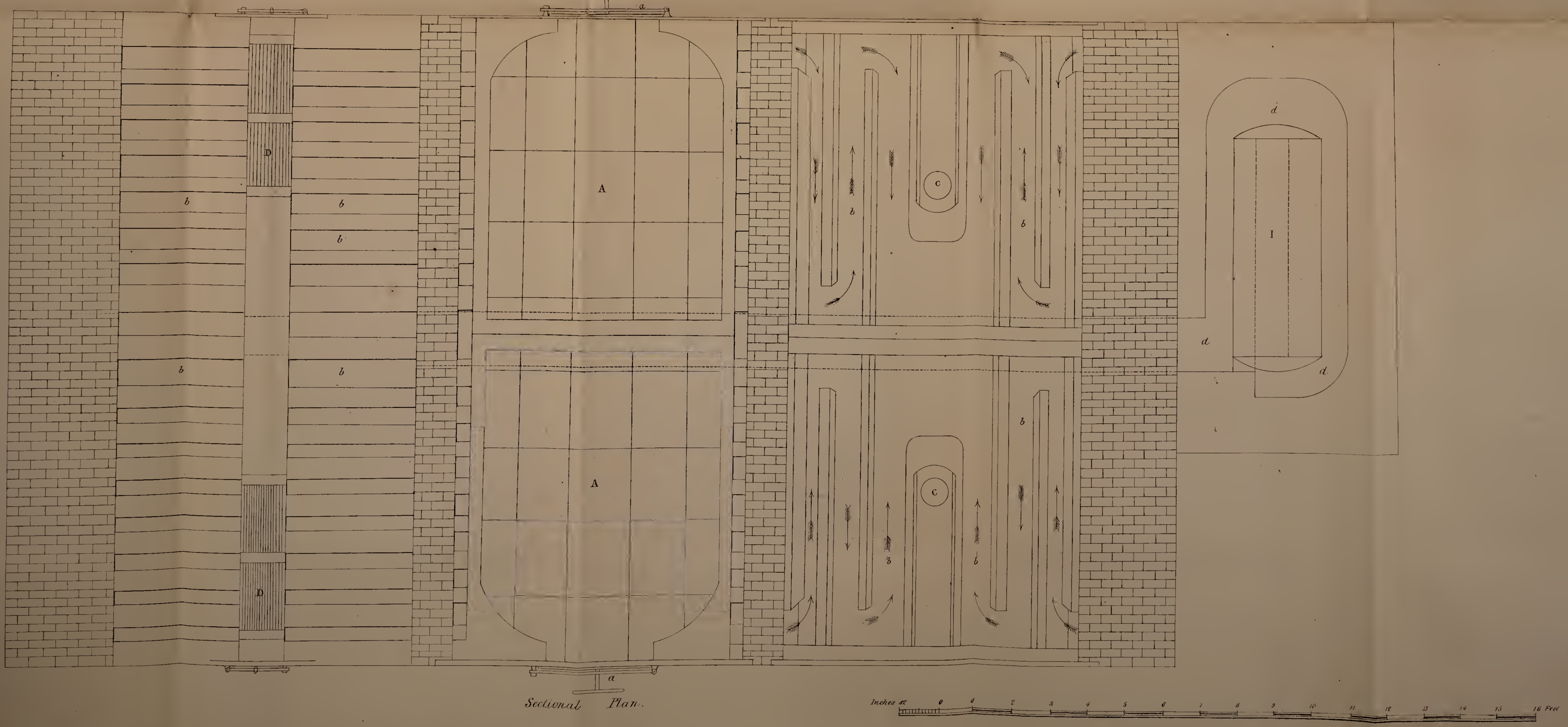


FIG. 5.



Sectional Plan.

The enrolled drawing is colored.

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FIG. 7.

LONGITUDINAL SECTION.

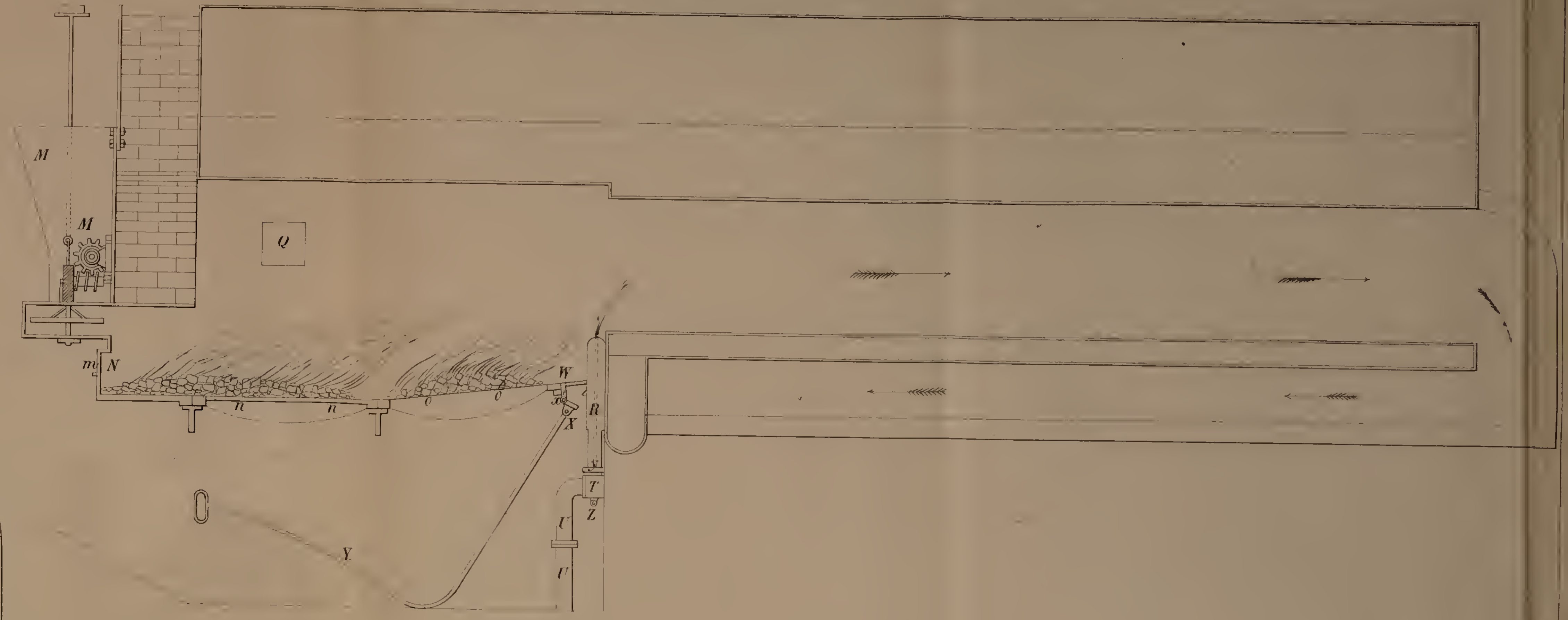


FIG. 6.

END ELEVATION

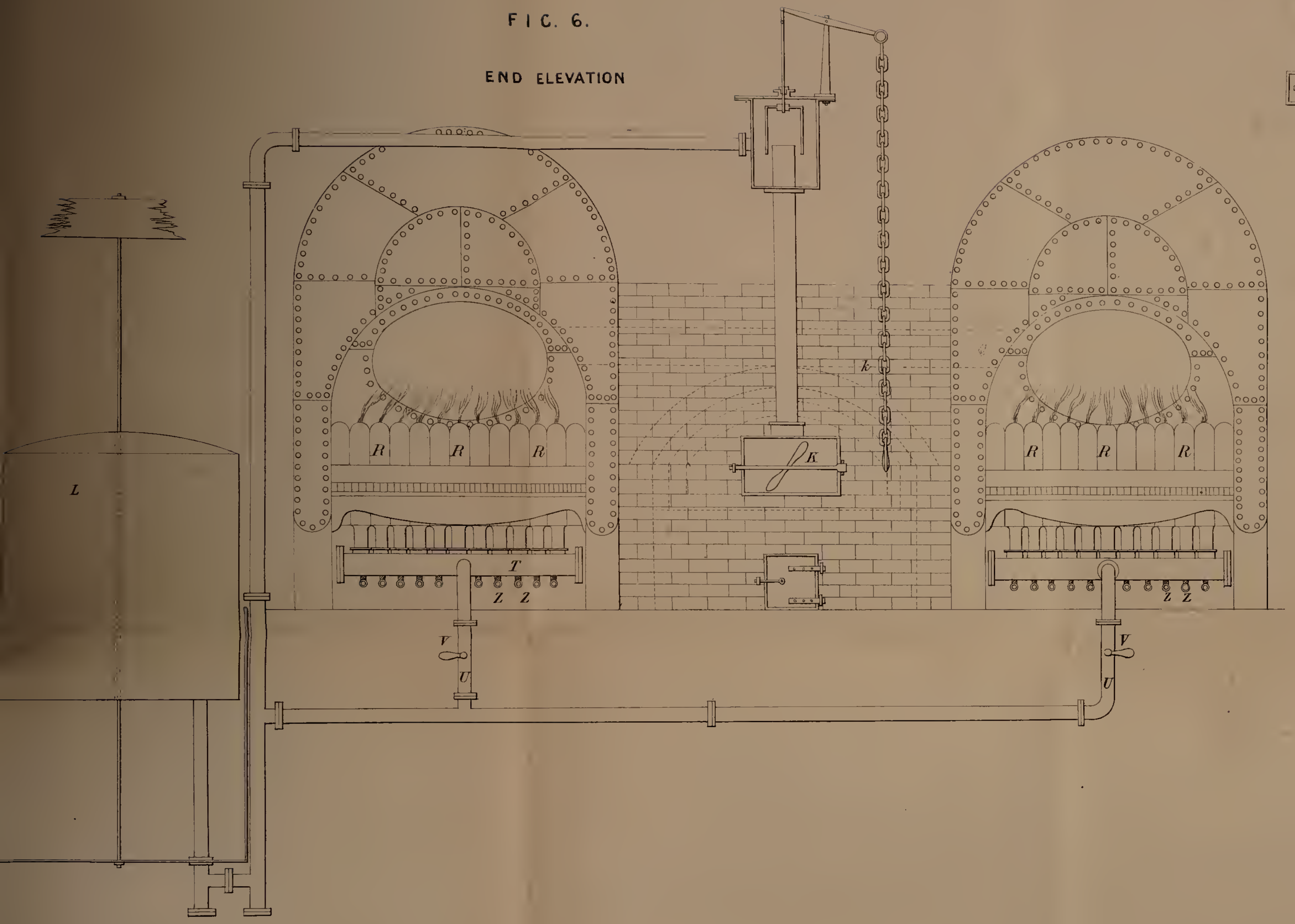


FIG. 8.

PLAN.

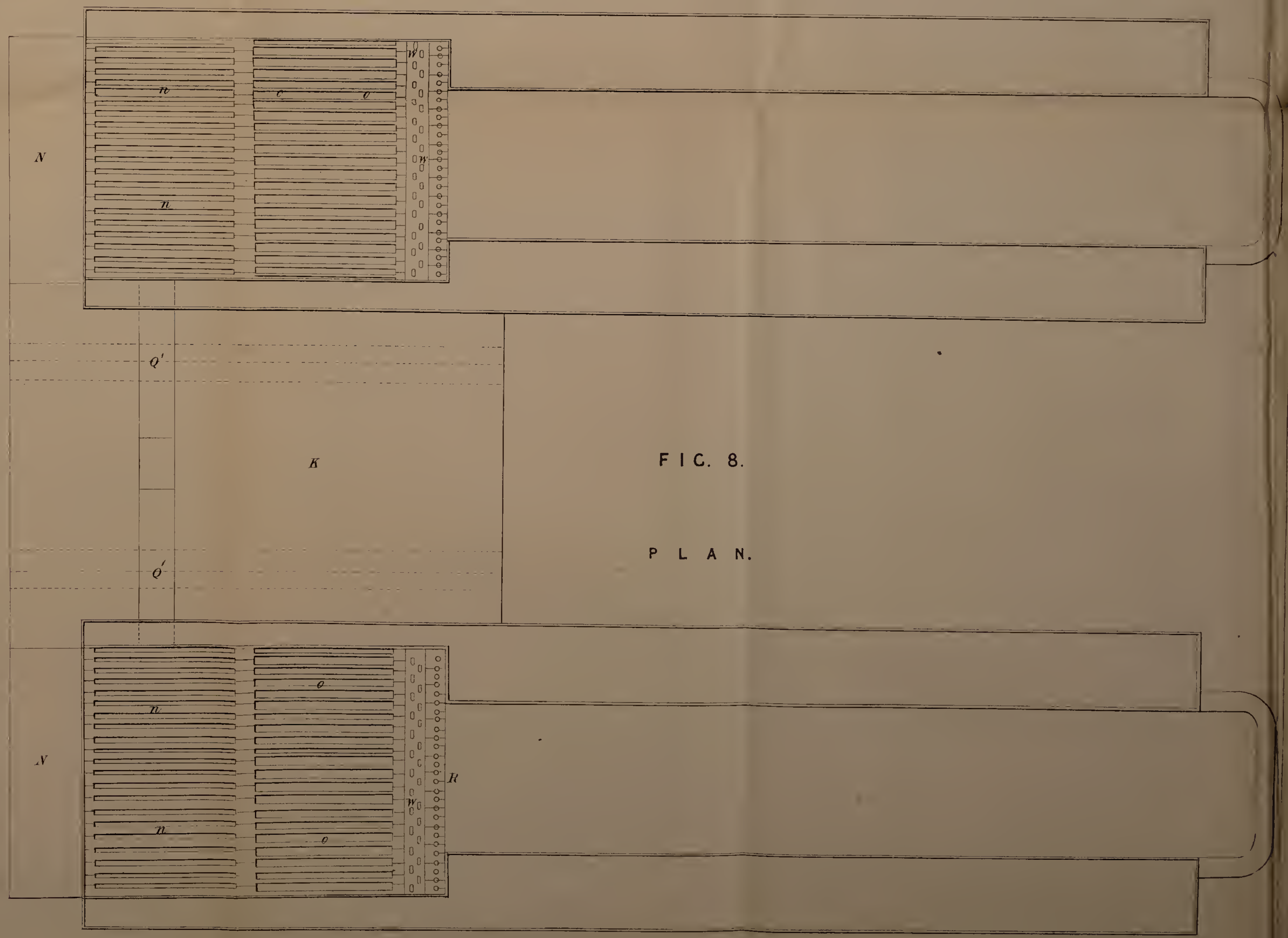
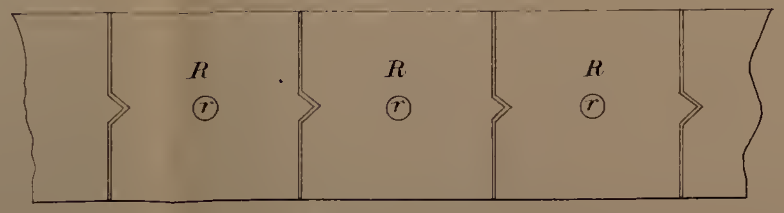


FIG. 9.



QUARTER SIZE.

Scale of Feet.

The enrolled drawing is partly colored.

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Kingdom of Great Britain and Ireland called England, Her Dominion of Wales, and Town of Berwick upon Tweed, I deliver this as my true and faithful Specification of the same.

In witness whereof, I, the said George Emmott, have hereunto set my hand and seal, this Fifteenth day of December, in the year of our Lord One thousand eight hundred and forty-eight.

GEORGE (L.S.) EMMOTT.

Signed, sealed, and delivered by the within-named George Emmott (having been first duly stamped) in the presence of

Cha. Cooper,
Sol^{r},
Manchester.

AND BE IT REMEMBERED, that on the Fifteenth day of December, in the year of our Lord 1848, the aforesaid George Emmott came before our said Lady the Queen in Her Chancery, and acknowledged the Specification aforesaid, and all and everything therein contained and specified, in form above written. And also the Specification aforesaid was stamped according to the tenor of the Statute made for that purpose.

Enrolled the Sixteenth day of December, in the year of our Lord One thousand eight hundred and forty-eight.

Cooper, Extra.

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